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VOL. IV. NEW YORK, FEBRUARY, 1900. No. 12

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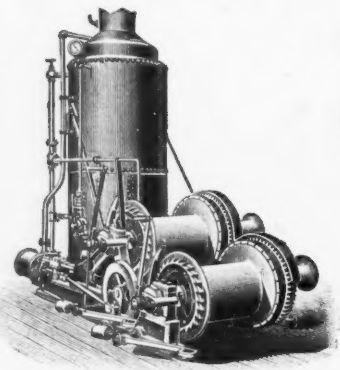

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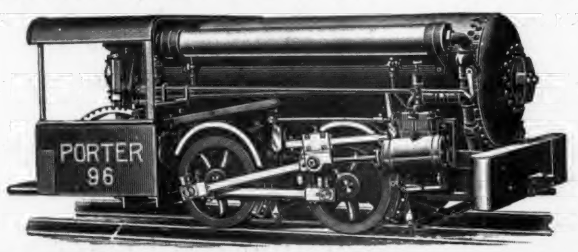

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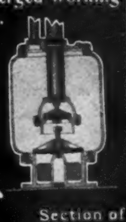

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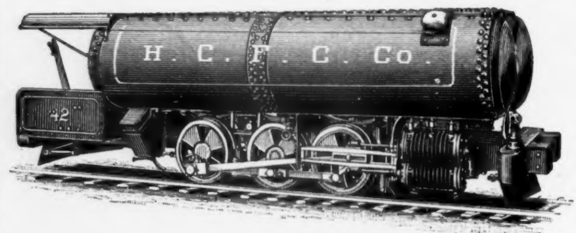

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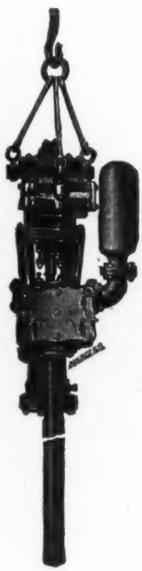

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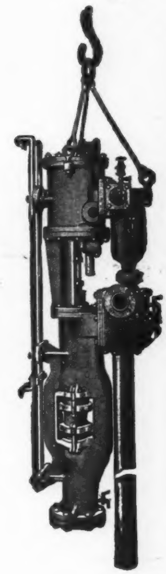

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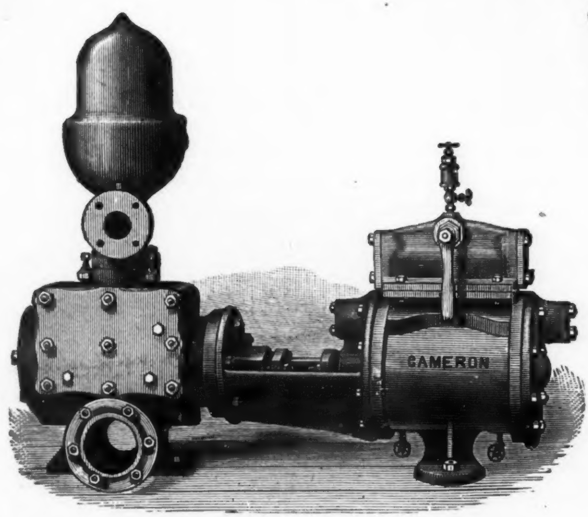

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Subscription, including postage, United States, Canada and Mexico, $1.00 a year. All other countries, $1.50 a year. Single copies, 10 cents.

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VOL. IV. FEBRUARY, 1900. NO. 12.

We had occasion in our last issue to refer to Pneumatic Traction, making specific reference to the plant which has been installed by the American Air Power Company, on the Twenty-eighth and Twenty-ninth Street Crosstown lines, New York City. This is the largest pneumatic traction installation that has ever been attempted, and its importance must be recognized. Nineteen cars of the Hoadley-Knight pattern have been running for some months, and it is now proposed to place some of the Hardie cars on the same line for the purpose of comparison. This illustrates the broad view of the subject taken by the American Air Power Company, and their determinaion to test pneumatic traction thoroughly and to adopt that system which is best. Fortunately, there is at the head of this company a practical street railroad man, who appreciates the situation, and who is reasonably sure to accomplish good results in the present case. It is, however, a matter of surprise that a duplicate generating plant has not been installed. Electric light installations, electric traction plants and such like are almost invariably equipped in duplicate. Pumping plants, and in fact wherever the centralized system is used, it has been considered wise not to depend on one machine or one set of machines, yet in this case there is one large air compressor of 1,500 H.P. capacity, upon which the whole system depends. That the cars should be kept in motion so constantly, notwithstanding the mechanical difficulties which are sure to arise in the development of any new system, is a point in favor of pneumatic traction, and that the cars may at any time be taken off and horses substituted is an illustration of the fact that a pneumatic equipment on the automobile plan may be applied to standard horse car roads, and that the installation itself is simple and inexpensive. We are heartily with the American Air Power Company in this work. We admire the pluck that they have exhibited in spending money to try experiments on a broad scale, and we have no doubt that this same spirit will follow them until the road has passed experimental conditions, and is an accepted success—a credit to the company and to those who have always believed that a good system of running street cars by compressed air would some day be brought to the front.

With the next issue COMPRESSED AIR enters its fifth year. It has enjoyed the continuous patronage of nearly all its first subscribers, and the subscription list has had a satisfactory growth. The demand for back numbers proves the value of the earlier publications.

Anticipating this condition, we have kept a supply of these on hand, but at the present we can only furnish Vol. III. complete. We have only a few numbers left of either Vol. I. or Vol. II., and orders for these will be filled at 10 cents per copy.

Theoretical

Discharge of Air from Pipes under Heavy Losses of Pressure.

(CONTINUED).

By William Cox.

Some time ago I was asked to solve the following problem:

What volume of free air will pass through a 3 inch air line, 6,000 feet long, the initial air pressure being 125 pounds and the terminal 80 pounds? Also how much will pass if the terminal pressure is 60 pounds, other conditions remaining the same?

Here, then, we have the following data to work from:

3 inch pipe, $c\sqrt{d^5}=876$

6,000 feet, $\sqrt{l}=77.46$

125 pounds pressure, $w_1=0.7230$, and $\sqrt{w_1}=0.85$

80 pounds final pressure $=p_2$, then

$p_1-p_2=45$ lbs., and $\sqrt{p_1-p_2}=6.71$

Also 60 pounds final pressure $=p_2^-$, then

$p_1-p_2=65$ lbs., and $\sqrt{p_1-p_2}=8.06$

Now, inserting these in equation (2) we get in the first case

$$\left.\begin{array}{l}\text{Discharge of com-}\\ \text{pressed air in cubic}\\ \text{feet per minute..}\end{array}\right\}=\frac{876}{0.85\times 77.46}\times 6.71$$

$$=13.3\times 6.71$$

$$=89.243 \text{ cubic feet air at 80 pounds terminal pressure,}$$

and in the second case

$$\left.\begin{array}{l}\text{Discharge of com-}\\ \text{pressed air in cubic}\\ \text{feet per minute...}\end{array}\right\}=\frac{876}{0.85\times 77.46}\times 8.06$$

$$=13.3\times 8.06$$

$$=107.198 \text{ cubic feet air at 60 pounds terminal pressure.}$$

To find the equivalent in free air of any volume of compressed air we have

$$\text{Equivalent free air}=\text{Compressed air}\times\frac{G+14.7}{14.7}\ldots\ldots\ldots\ldots(3)$$

where G is the gauge pressure of the volume of compressed air.

The writer has simplified this by reducing it to the form

$$f=\frac{G+14.7}{14.7}=1+0.068\,p\ldots\ldots\ldots(4)$$

where f is a factor to reduce compressed air at pressure p to its equivalent volume of free air.

Inserting the values of p_2 in Eq. (4) we get for terminal pressure 80 pounds

$$f_2=1+(0.068\times 80)=6.44$$

and for terminal pressure 60 pounds

$$f_2=1+(0.068\times 60)=5.08.$$

Equation (3) may now be put into the form

$$\text{Equivalent free air}=\text{Compressed air}\times f_2.(5)$$

which gives us in the first case for 80 pounds final pressure,

Discharge of free air $=89.2\times 6.44$
$=574$ cubic ft. per min.,

and in the second place for 60 pounds final pressure,

Discharge of free air $=107.2\times 5.08$
$=544$ cubic ft. per min.

It results, therefore, that with a reduction of the final pressure by 20 pounds, we actually obtain a smaller discharge of equivalent *free* air, although, as already shown, we have a larger output of compressed air. And how do we know that with 80 pounds final pressure we do not obtain a smaller discharge of equivalent free air than we should do with a final pressure of 90 pounds? In other words, *Where is the limit?* WHAT IS IN ANY GIVEN CASE THE LOWEST USEFUL FINAL PRESSURE? This is a very important point for the compressor builder and for the compressed air user, who always calculate on the basis of free air. It is shown by the solution of the above problem that with very heavy losses of pressure in a pipe line, a smaller equivalent volume of free air can be forced into the pipe than with more moderate pressure losses, the initial pressure remaining the same. How many pipe lines have given results below what was expected, through ignoring this fundamental principle, and how often has the cause for the failure been accounted for in any way but the correct one?

Combining equations (1) and (4) we now obtain the following general formula for the discharge of equivalent free air from pipes:

$$\left.\begin{array}{l}\text{Discharge free}\\ \text{air in cubic}\\ \text{ft. per min.}\end{array}\right\} = c\sqrt{d^5}\,\frac{f_2 \times \sqrt{p_1 - p_2}}{\sqrt{w_1} \times \sqrt{l}} \ldots (6)$$

In those cases (such as the problem under consideration) where the diameter and length of a pipe, as well as the initial pressure, are constant, and the final pressure only varies, the formula may be put

$$\left.\begin{array}{l}\text{Discharge free air in}\\ \text{cubic feet per minute.}\end{array}\right\} = \left(\frac{c\sqrt{d^5}}{\sqrt{w_1} \times \sqrt{l}}\right) \times (f_2 \times \sqrt{p_1 - p_2}) \ldots\ldots\ldots\ldots (7)$$

it being then at once seen that as the first factor on the right hand of the equation is constant, the discharge of equivalent free air varies exactly in proportion to

$$(f_2 \times \sqrt{p_1 - p_2}),$$

that is, in a certain degree, according to the final pressure. By this arrangement of the formula we are enabled to examine easily the effects produced upon the discharge by variations of the final pressure, as the only factor with which we have to deal is the second one on the right hand of equation (7). By calculating values of

$$(f_2 \times \sqrt{p_1 - p_2})$$

for a number of terminal pressures in a given case, we can at once and easily compare them, and select a limit which should not be exceeded in order to obtain results such as may be desired.

And here it is important to note that as p_2 increases in value, f_2 decreases in value, and *vice versa*, so that there must be a point at which the value of

$$f_2 \times \sqrt{p_1 - p_2}$$

is a maximum, and consequently the discharge of equivalent free air from the pipe is also a maximum, and any further pressure absorbed in friction beyond this maximum value of $p_1 - p_2$ or minimum value of p_2, produces a diminution of the discharge, which is absolute loss of economy.

Suppose an air compressor to be rated to compress 574 cubic feet of free air per minute to 125 pounds, and that this air is forced through a pipe of such diameter and length that the terminal pressure is 80 pounds. Now, if that terminal pressure is reduced to 60 pounds, the compressor will only have to compress 544 cubic feet of free air per minute to 125 pounds, so that it is not working up to its full capacity by 30 cubic feet a minute, or more than 5 per cent. And yet who will affirm that the real work done by the compressor is not as great in one case as in the other?

What is in any given case the Lowest Useful Final Pressure, and how is it ascertained?

Taking the problem before us, and leaving out of consideration the factor

$$\left(\frac{c\sqrt{d^5}}{\sqrt{w_1} + \sqrt{l}}\right)$$

which has no effect upon this question of final pressure, let us take a few different final pressures and tabulate them thus:

Table III.

p_1	p_2	f_2	$p_1 - p_2$	$\sqrt{p_1 - p_2}$	$f_2 \times \sqrt{p_1 - p_2}$
lbs.	lbs.		lbs.		
125	85	6.78	40	6.3246	42.88
125	80	6.44	45	6.7082	43.20
125	75	6.10	50	7.0711	43.13
125	70	5.76	55	7.4162	42.74
125	65	5.42	60	7.7460	42.00
125	60	5.08	65	8.0623	40.94

Here we see that the maximum value of

$$f_2\sqrt{p_1 - p_2}$$

is somewhere about where $p_2 = 80$ pounds, that is, in any case, when the value of p_2 lies somewhere between 75 and 85 pounds. It may be more or it may be less than 80 pounds. We, therefore, now tabulate a little further as follows:

Table IV.

p_1	p_2	f_2	p_1-p_2	$\sqrt{p_1-p_2}$	$f_2 \times \sqrt{p_1-p_2}$
lbs.	lbs.		lbs.		
125	82	6.576	43	6.5574	43.1215
125	81	6.508	44	6.6332	43.1689
125	80	6.440	45	6.7082	43.2008
125	79	6.372	46	6.7823	43.2168
125	78	6.304	47	6.8557	43.2183
125	77	6.236	48	6.9282	43.2043

From this we see that the highest value of

$$f_2 \sqrt{p_1-p_2}$$

is 43.2183. which is obtained when the terminal pressure is 78 pounds. This is then the limit sought, or the lowest useful final pressure for an initial pressure of 125 pounds. For other initial pressures the limit can be found in the same way. It must be admitted that it is somewhat tedious, but the result in any given case may far more than compensate for the time and labor bestowed. The writer has worked out these limits for a full range of initial pressures from 10 to 1,000 pounds.

Applying now the limit of 78 pounds, as found above, to the problem under consideration, we have by inserting the known values in equation (7)

$$\left.\begin{array}{r}\text{Discharge of free air in}\\ \text{cubic feet per minute.}\end{array}\right\} = 13.3 \times 43.2183$$
$$= 574.80 \text{ cubic feet.}$$

The exact discharge for 80 pounds terminal pressure is $43.2008 \times 13.3 = 574.57$ cubic feet. The difference is so slight that 80 pounds may be practically considered as the lowest limit beyond which, for the sake of economy, the terminal pressure should not be allowed to fall.

From a careful consideration of this problem it will be evident that all use of the simple term "air" should be accompanied by a clear comprehension of what is meant, and what it involves. Confusion may lead to serious consequences.

Viewed in the light of what is here shown it would be both interesting and profitable to reduce the volumes of compressed air given in Table II. to their equivalent volumes of free air. A certain point will then probably be found which is not the "lowest useful final pressure," but rather the most *economical* one, when the cost of the compressed air at its initial pressure, and the amount of effective work which may be obtained from it at terminal pressure are duly considered.

Miscellaneous Applications of Compressed Air

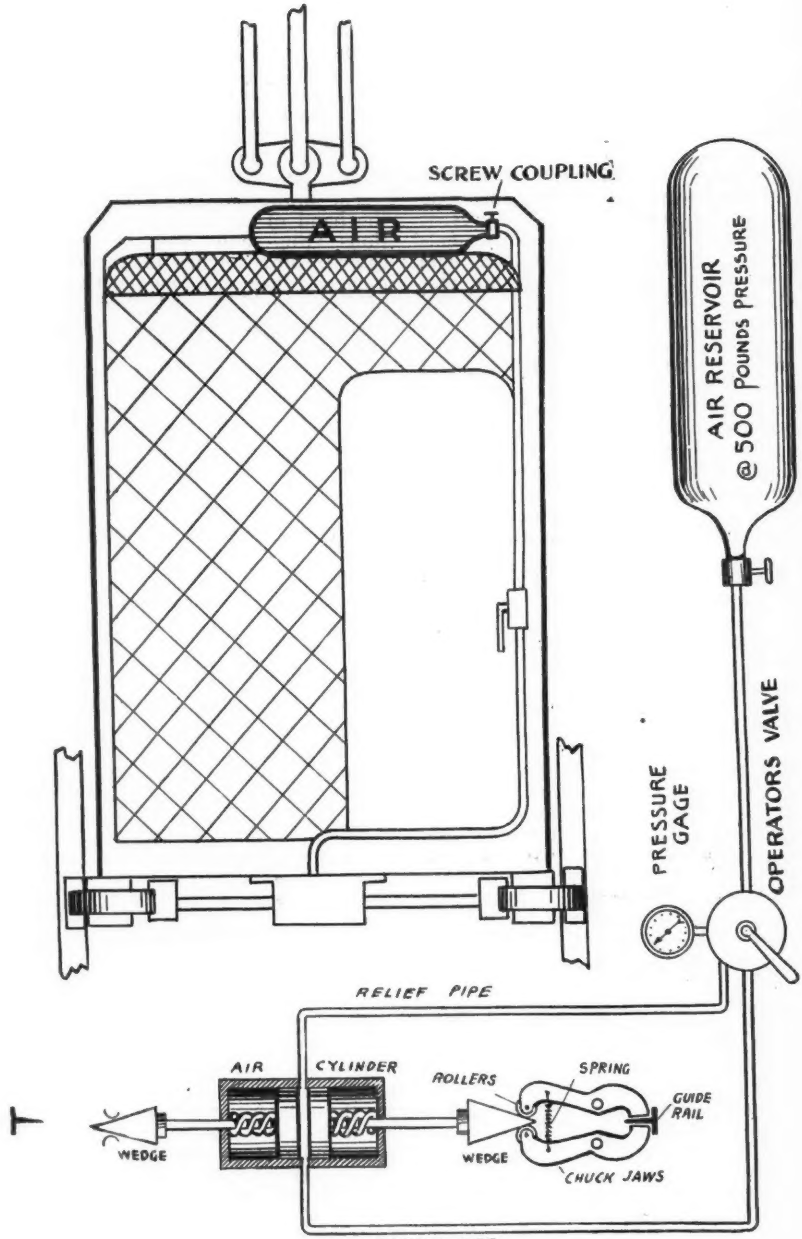
A Pneumatic Elevator Safety.

The statement has been made on good authority that the elevators in New York City carry more passengers than the surface cars. Whether this is true or not, it must be admitted that there are grounds for the claim. In other cities, with the exception of perhaps Chicago, we question whether the proportion would be more than 25 per cent. In any case, the statement serves as food for thought, and suggests a comparison of other features.

Two fundamental differences exist between the two forms of transportation. First, the elevator travels in a vertical plane, while the tram moves in a horizontal plane. Again the tram car, with the exception of the cable road, is always independent. The elevator car from the nature of things, cannot be self-propelling and must always depend upon the lifting cables.

Also, since there is only one car in the case of the elevator it is ordinarily possible to stop or start the entire operating apparatus when it is desirable to stop or start the car. There are, however, occasions when brakes or some means of quickly and surely stopping are of vital importance.

Generally speaking, the present forms of elevator brake must of necessity differ from a tram brake, as they cannot be applied on the up trip without the greatest



PNEUMATIC ELEVATOR SAFETY.

risk, and the action on the down trip is mostly a matter of uncertainty.

In railroad practice the prime requisites of a brake are reliability, absolute control on the part of the engineer, and sufficient power for all possible demands.

It would seem that the same conditions are quite as essential for an elevator brake, certainly absolute control on the part of the operation is the only one which can be questioned. With present forms control by the operator is inadvisable and we may say impossible. The only reasons for this statement are that the operators may become confused and present clutches, catches and safties, all depend upon springs or wedges which are driven in by the falling of the car, and there is no way to adjust these with the necessary nicety that is possible with street or tram cars.

In answer to the first of these objections, it may be stated as a general proposition that a given operator would be less rattled with a braking device over which he has control, than one over which he has no control.

Further, if he had the perfect confidence which frequent handling and testing inspires, the probabilities are that he would be no more confused than the engineer of a train or the average motorman.

The second proposition can only be answered by suggesting some form of brake which will admit of an adjustment by the elevator operator.

A review of the conditions outlined causes one to wonder why the air brake, which has proved so satisfactory in the case of horizontal vehicular traffic, has not been applied to those moving in a vertical direction. To better illustrate this idea, the accompanying sketch has been prepared. It shows an elevator car equipped with an air brake and illustrates in a general way the principle involved.

The car is provided with two companion clamp jaws for each guide rail, and these jaws may in addition to their function of brakes serve as guides. These jaws are ordinarily held apart by some form of spring and thus permit a free movement of the car up or down. Centrally placed between the clamps is a cylinder with two pistons as shown. In some accessible place, either on top or at the bottom of the car, is a steel bottle or reservoir, designed for a pressure of 500 lbs. pressure. This is connected through a suitable system of piping to the brake cylinder, and an engineer's valve placed beside the operator or, if necessary, forming part of the elevator starting lever. A small gauge just in front of him shows the pressure in the reservoir, so that a positive indication is always given of the working condition of the system.

The brake handle, which is always in the hand of the operator, has two positions, "Slip" and "Fall," which are indicated by stop notches like those of the engineer's brake on a locomotive. The first of these would be used when the elevator speed increased more or less gradually, and the second for a sheer fall.

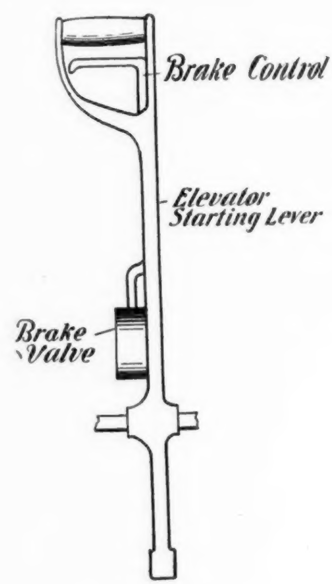


FIG. 2. ELEVATOR BRAKE.

The safety could be actually and instantly tested once a day or once a week by the elevator operator by one movement of the same lever with which he continually stops or starts the elevator. This practice would make him so familar with the apparatus that he would not get rattled in case of a fall. Reservoirs could be replenished each night from a small

compressor in basement, using a hose to connect with the tank on the car; or new cylinders could be slipped into place when the pressure gauge indicated an insufficient pressure; or a flexible hose could be connected with a compressor in the basement and allowed to trail after the car.

Another plan would be to have a little compressor on the bottom of the car, which would be driven by a small hemp rope, running from top to bottom of the shaft.

Probably the best way would be to have closed bottles with air under high pressure, say 2,000 lbs., which could be placed on the car once a month or two months, or even at longer intervals. A suitable reducing valve would then drop the pressure to 500 lbs. or whatever working pressure was decided upon.

The following abbreviated calculation will show the operation of such a system.

Assume car and passengers to weigh 5,000 lbs.

In case of accident this must be carried on two clamps, or 2,500 lbs. each.

Assume coefficient of sliding friction* to be .04, which is conservative for a speed of 50 miles per hour. (50 × 5,280=214,000 ft. per hour, 3,560 ft. per minute or 59.3 ft. per second.)

Assume brakes applied at the end of a two-second fall, the distance fallen would be

$$s = \tfrac{1}{2}\, gt.^2 = 16.2 \times 2^2 = 64.8$$

Therefore the clamping pressure necessary on each jaw to hold the load imposed by falling at the rate mentioned would be

$$\frac{2,500}{.04} = 62,500 \text{ lbs.}$$

Allowing a factor of safety of 4 to cover any uncertainty in the character of the friction between the clamps and the guide rail we have

$$4 \times 62,500 = 250,000 \text{ lbs.},$$

or the amount each pair of jaws must clamp.

Assume the clamp jaws to have a short arm of 2½ ins. and a long arm of 12½ ins. or a ratio of 1 to 5

$$\frac{250,000}{5} = 50,000 \text{ lbs.}$$

or the amount which must be applied at end of the long arm.

*"Kent," page 928.

Let the wedge angle equal 10° total, or 5° on each side of the axis, then

Cos 10° × 50,000 = .98481 × 50,000 = 49,240 lbs. normal.

49,240 × sin 10° = 49,240 × .1736 = 8,547 lbs., which is the thrust the piston must receive to force the wedge between the long arms of the clamp levers.

Assume a working pressure of 100 lbs. per sq. in.

$$\frac{8,547}{100} = 85.47 \text{ sq. ins.}$$

A circle 10½ ins. in diameter has an area 86.59 sq. ins., so the working cylinder would require a diameter of 10½ ins.

With 500 lbs. working pressure the cylinder diameter would be about $5\frac{7}{32}$ ins.

If we allow ⅛ in. clearance between jaws and ⅛ in. for lost motion there will result ¼ in. movement for the short arms of the clamp.

¼ × 5 = 1¼ ins. for the long arm, or we will assume 1 in. With a wedge ratio of 10 to 1 each piston must move 10 ins., in opposite directions, or a total of 20 ins.

85 sq. ins. × 20 = 1,700 cu. ins. or about 1 cu. ft. per application of the safety.

A tank 9 ins. in diameter and 4 ft. long =63 × 48=3,024 cu. ins. or about 2 cu. ft.

At 500 lbs. this tank would be capable of about 10 actual applications of the safety, something which would require about as many years, if past experience is considered.

With a pump on the car driven by a rope, as described, with a cylinder having an area of 1 sq. in. and a 4 in. stroke making 40 strokes per minute the tank could be filled with air at 100 lbs. pressure in about two hours, or if allowed to run continually the safety could be given a working test twice per day and at the same time always be ready for emergency.

J. J. Swann.

A Collection of Blacksmiths' Tools.

An interesting feature of the last annual convention of the National Railroad Master Blacksmiths' Association was the introduction and description to the members of a large variety of labor-saving appliances which one or other of the members had devised for assistance in his daily work. Naturally most of these devices were in the line of forms for bending, shaping, upsetting and riveting, for

use on those parts of locomotive and car work upon which a large number of processes are necessarily duplicated, and in most instances the tools form a part of the equipment of a pneumatic bulldozer or hammer, also of home production. Photographs and descriptions of several of these appliances have been collected from the secretary and members of that association and are presented here as containing valuable suggestions to those who are engaged upon similar work.

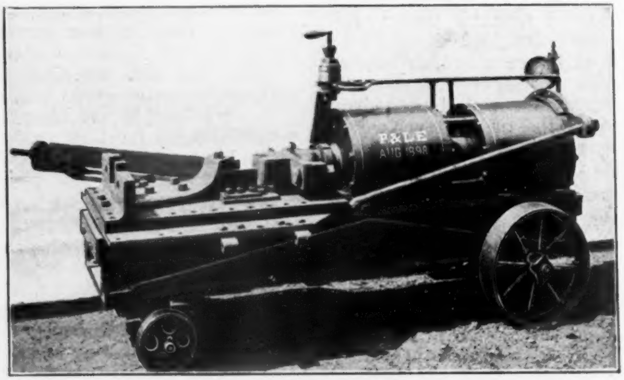


FIG. 1. A PORTABLE PNEUMATIC BULLDOZER.

Figures 1 to 4 of the accompanying illustrations show a pneumatic machine, a collection of formers for use with it, and some specimens of work done. This machine is in use at the shops of the Pittsburg & Lake Erie Railroad at Pittsburg, in the blacksmith department, under the direction of Mr. A. W. McCaslin. The pneumatic bulldozer was built of scrap or useless material on hand, and consists of two 16-inch cylinders placed tandem fashion on a frame made of two 10-inch I-beams, each 8 feet in length, with a piece of 80-pound rail riveted on the inside of the web of each beam. The frame is covered with a wrought-iron face plate. The piston rod is 4 inches in diameter, and with an air pressure of 125 pounds an effective or working pressure of 25,000 pounds is obtained from each cylinder, or 50,000 pounds from the two cylinders. In using two cylinders upon a machine of this character, Mr. McCaslin states that he finds it more satisfactory to place them tandem rather than side by side, for the reason that the pressure from both is in a direct line. This is particularly valuable in upsetting, a class of work for which the machine finds the greatest demand, and which is not always satisfactorily met by the steam hammer.

The machine is capable of eight strokes per minute, and the output of any class of article depends upon the heating capacity and the activity of the operator.

Figure 1 shows the machine in position for bending the lips on drawbar yokes. The V-shaped die connected to the piston rod has a cutter upon one side, which shears off any surplus iron which may result from the bars not being cut off to the exact length required. For this purpose Mr. McCaslin originally used a tool with compound levers, by which means a pressure of 100,000 pounds was obtained. With this arrangement the lip was formed satisfactorily, but it was impossible to prevent the upsetting of the bar in the clamp in which it was held. In Fig. 3, numbers 9 and 10 are tools for forming the yokes themselves, form No. 9 having a bent yoke upon it and the crown-retaining lever lying in front of it.

In Fig. 2 the same machine is shown as arranged for riveting drawbar yokes. The hinged apron receives the drawbar as it is dumped from a truck. The air hoist, which is suspended above the machine, lifts the apron with the drawbar and throws the latter into position for receiving the rivets. The latter are $1\frac{1}{8}$ inches in diameter. When the riveting is completed the apron is lowered as it was raised. It is stated that with 50 pounds'

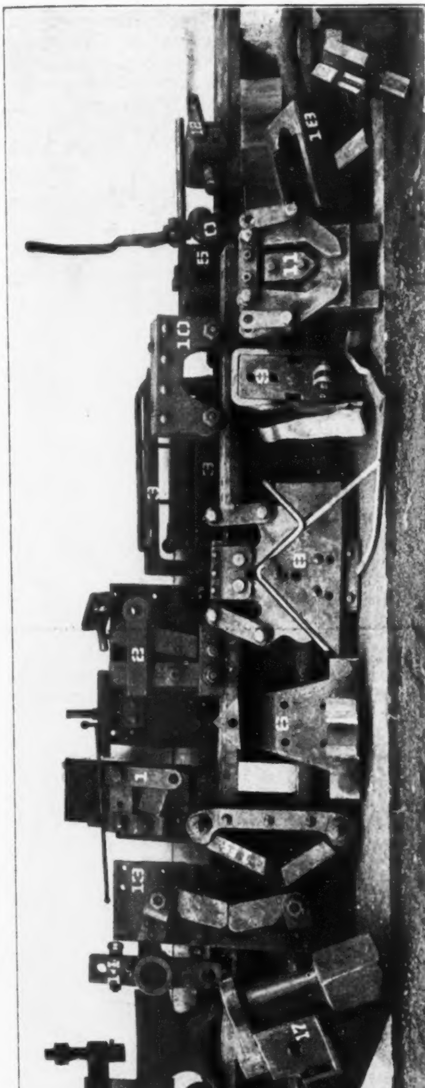


FIG. 3. TOOLS USED WITH PNEUMATIC BULLDOZER.

air pressure 150 yokes can be riveted in ten hours, and the operation involves no lifting by hand.

Figure 3 shows a group of forms for various purposes, the number of which is being constantly increased. No. 1 is a tool for upsetting a 1⅛-inch ball on the end of ⅝-inch round iron for grab-irons. No. 5 (with O representing the piston rod) is for completing grab-irons. The capacity is 200 from the bar in ten hours. No. 2 is for upsetting the ends of 1¼-inch truss rods. The capacity is 400 in ten hours, or as many as can be handled. No. 3 are forms for bending brake lever carriers. These have rollers in the angle or bearing ends, as has also No. 10, previously mentioned, to lessen friction on the iron. No. 6 are the forms shown on Fig. 1 for bending lips on drawbar yokes. No. 8 is a tool for forming, cutting or unlocking pin levers, and No. 10 (next to No. 9) is the tool in which the connecting end of the lever is formed, and which is bolted to an angle on the face plate of the machine. No. 11 is for forming brake-hanger stirrups. This is the ordinary hand tool, with auxiliary levers for connecting it to the piston crossbar. No. 12 is for upsetting heads on 1¾-inch king or centre pins. The rate is one per minute. Nos. 13 and 15 are adjustable tools for bending arch-bars of any size or to any angle. No. 14 is the piston crossbar to which the movable parts of all formers are bolted. This has rollers on the under side and prevents the piston from turning. Nos. 20 and 21 are yoke-riveting cup tools.

There are many other tools of similar character used with this machine, such as key-way punches, formers for car steps, coach steps, drawbar carriers and air brake work. Fig. 4 shows samples of a variety of the work done and also an axle straightening lathe and crane combined, which have been built at the same shops.

Figure 5 is a machine for similar work, which was built by Mr. J. E. Mick, of the Baltimore & Ohio Southwestern, at Chillicothe, O. Dies for making drawbar pockets and nearly all kinds of plain work have been made for use with it, and some of the varieties of finished parts are shown in the engraving.

Mr. John Coleman, of the Chicago & Northwestern shops at Clinton, Ia., devised the hammer shown in Fig. 6 for use at the spring fire in drawing and clipping

spring leaves, holding down bands while the sides are driven to place, as with a screw press, etc., and a variety of similar light work, in which it has come to be recognized as one of the most useful tools in the shop. The cylinder is 6 by 22 inches and the weight of the hammer and piston rod 300 pounds. It is used with an air pressure of 90 pounds.

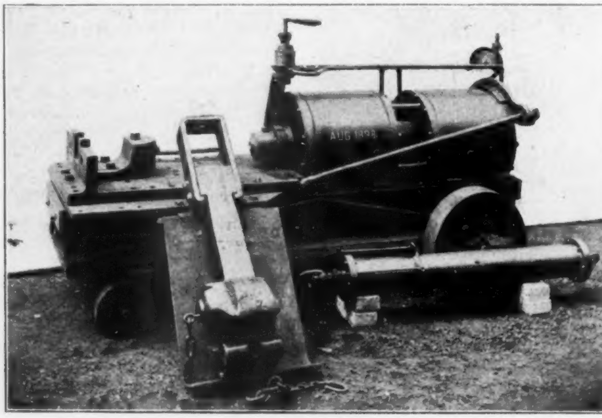


FIG. 2. PNEUMATIC RIVETING ON DRAWBAR POCKETS.

The secretary of the Master Blacksmiths' Association, Mr. A. L. Woodworth, of the Cincinnati, Hamilton & Dayton, at Lima, O., is the designer of the group of tools shown in Fig. 7. The most conspicuous tool in the engraving is a former for bending corner steps for freight cars, the lever at the left of the figure being removed to show the construction of the dies. When in use the bedplate of the device is clamped to an anvil, as shown. The movement of the levers bends the blank to form the horizontal part of the step, and the offset on each arm catches the blank as the lever closes against he bed, thus turning it down at the end to whatever distance may

FIG. 4. AXLE STRAIGHTENING LATHE AND SAMPLES OF BENDING.

be desired. Both ends are bent and turned at the same time. With the size of iron used, ⅜ by 2 inches, it is stated that from 250 to 300 steps are made by two menin a fair day's work. It is the intention to apply air power and thus about double the capacity. A sample of the finished product is shown in the foreground at the right.

The tool at the left of the engraving is for bending eyebolts, brake-hanger hooks and the like. The lever in which the iron is held has a slot for that purpose, and is pivoted at the end by a lug, which passes through the bedplate and is fastened by a cotter pin. The other lever is held by a stationary pin, which forms the pivot on which it swings. This lever carries a roller. In operation the iron is placed in the slot and a slight movement given to the slotted lever brings the body of the bolt central with the eye. The longer lever, with its roller resting against the iron, is then carried around, wrapping the blank around the stationary pin forming the eye. This tool is also clamped on an anvil when in use, and from 40 to 50 ¾-inch eyebolts may be made in an hour by one man.

The tool just to the right of the anvil is a very successful device for bending collars for the heads of drawbar stems. The size of iron used is ⅝ by 1½ by 8 inches long. The mandrel around which the collars are wrapped is 2⅛ inches in diameter and has a lever to hold the iron in place while being bent. The lower end of the mandrel passes down through a hole in the plate, as shown. The device is operated by air. The levers which are attached to the piston rod of the air cylinder have at their opposite ends rollers carried by 1¼-inch bolts passing through curved slots in the bed. As soon as the blank is wrapped around the mandrel until the centre is reached, the curved slots bring the rollers in close together behind the mandrel, thus making the blank form a perfect circle. The mandrel is then raised, and the collar falls off. The capacity is limited only by the capacity for heating.

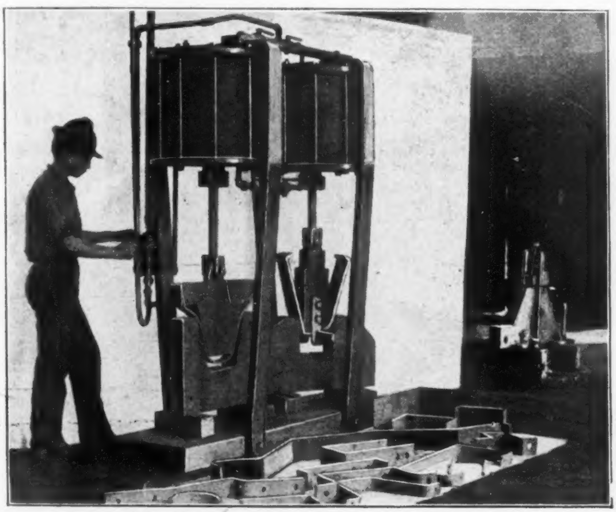


FIG. 5. PNEUMATIC PRESS FOR BENDING.

The tool to the extreme right is precisely similar in principle, except that it works under the steam hammer, and is intended for bending brake-hanger loops. In use the plate is bolted in an upright position to the bottom die of the hammer, and the arms are hinged to the upper die. The rollers are flanged in order to hold the iron close against the plate while bending.

A considerable number of other tools of a similar class have been developed as

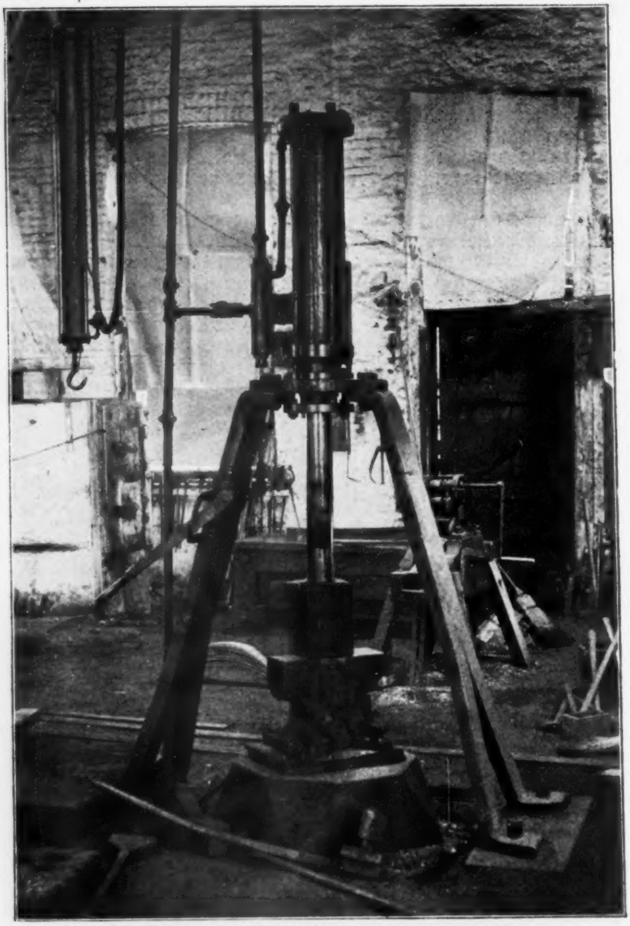


FIG. 6. PNEUMATIC HAMMER FOR SPRING WORK.

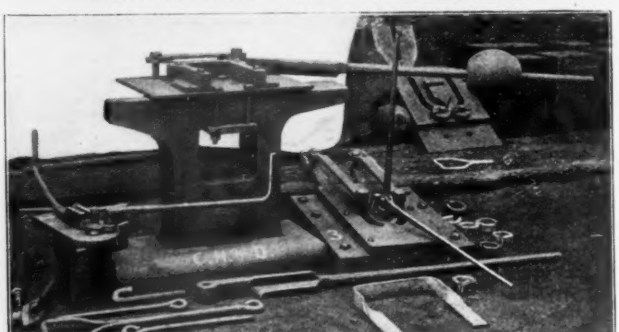
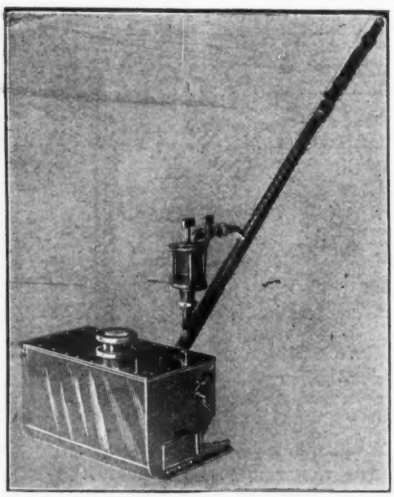


FIG. 7. TOOLS FOR BENDING STEPS, EYEBOLTS, ETC.

a result of a necessity for rapid work in the various railway blacksmith shops of the country. An indication of the extent to which such tools have been put in service is shown by the statement of one railway blacksmith that he has in his shop nearly 3,000 forms for bending, forging, etc. The above are given as suggestive of the ease with which a shop equipment may be increased with small initial expense.—*Railway Age.*

Mechanical Housecleaning.

Some months ago there was described in these columns a device known as the "House Renovator," which is a dustless system of cleaning, renovating and disinfecting hotels, residences, office buildings, hospitals and public institutions with compressed air. The scheme in general is not entirely new. Railroads have been cleaning their passenger and sleeping cars with compressed air successfully during the past ten years, but the device mentioned is designed for the purpose of not only knocking the dust and dirt out of their lodging places, but to imprison them before they have a chance to obtain another habitation.



House Renovator.

We all remember, nay, observe, the patient houseworker with a broom. She goes after the particles that lurk in the woof of the carpet and to give her due credit she gets many of them, but it's a wearing process and ends up with a lame back. The filmy dust picks out dark furniture, and children write their names in juvenile glee. It is further pursued and batted from one place to another, until somehow or other it gets out of sight again for awhile. After awhile the accumulations multiply and then comes housecleaning.

Here is where Mr. Thurman, of St. Louis, steps in. He claims not to disturb your carpets. By his system the walls are cleaned of all the dirt and dust, the carpets are thoroughly renovated, removing and collecting all the dirt and dust the carpet contains, also removing that dirt which is between the carpet and the floor. After the carpets are cleaned they are thoroughly disinfected, the disinfectants being blown on the walls and into the carpets with compressed air.

The process has many features which appeal to every one. The lessening of tiresome labor and the purifying of the atmosphere of living apartments are among the important ones.

By this method one man can clean from eight to twelve rooms per day, which includes walls, carpets, rugs, draperies, bedding and upholstered furniture.

Figure 1 shows the system operating in hotels, using an electric air compressor mounted on a rubber tired truck in which the power is supplied to operate the compressor from the electric light wires. This machine compresses air up to 90 pounds per square inch and stores the air in the air reservoirs mounted on the truck; the supply of air to operate the dustless carpet renovator is drawn from these reservoirs. The renovator is pushed back and forth over the floor in a similar manner to the ordinary carpet sweepers now in common use. The renovator collects all of the dust which the carpet contains, and after the room is cleaned the dust is dumped out into a receptacle.

Figure 2 shows the system operating in private houses having no electric light wire connection, the supply of air being obtained from bottles. These bottles are made of suitable size and are rolled of a solid billet of steel, into which is pumped compressed air at 3,000 pounds' pressure

per square inch. On the neck of these bottles are attached reducing valves, which reduce the air from 3,000 to 70 pounds per square inch. These bottles are filled at a central station, using high pressure air compressors, which are made especially for this company. These compressors are capable of filling from 18 to 20 bottles per day, and one bottle has sufficient capacity to clean five ordinary rooms and are tested up to 13,000 pounds per square inch. After the bottles are filled at the compressor they are loaded on a wagon and are delivered on the sidewalk of the residences to be cleaned. The hose is attached to the reducing valve of the bottle and is carried into the house and furnishes the proper amount of air to renovate the carpets and collect the dirt and impurities therefrom, as illustrated.

Mr. J. S. Thurman, the inventor of this system, has recently organized a company known as the General Compressed Air House Cleaning Company, and who are contractors and engineers for complete house cleaning equipment and compressed air plants, with offices in the Lincoln Trust Building, St. Louis. At the present time the company is arranging with parties who desire to get into this business in various cities and towns of the country, and are also arranging with hotels and institutions for the same purpose.

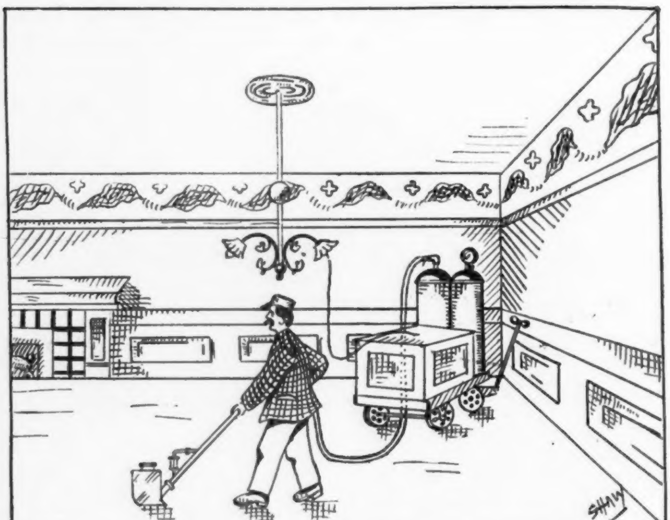


FIG. I. CLEANING CARPET BY COMPRESSED AIR—ELECTRIC AIR COMPRESSOR.

Pneumatic Work.*

I wish, before commencing the few remarks I have to make, to thank you for the honor you have conferred on me in asking me to speak on this subject. I wish to thank you before I begin, because your commiteeman, Mr. John W. Neil, asked me how long I expected to speak. I told him I thought I could say all I have to say in a quarter of an hour. He smiled and said: "So long?" I will try and cut it shorter.

In the first place, in regard to the pneumatic work foundation, to be done by the pneumatic method, your invitation committee asked me to read a paper on "Pneumatic Foundations." In these days of bicycles we are all very familiar with the pneumatic tire; some of us know the luxury of the pneumatic mattress. We associate in our minds with anything "pneumatic" an idea of something

* Address of Mr. D. E. Moran to the Central States Water Works Association.

springy; that will bounce. I can assure you that is not the kind of a foundation Mr. Bouscaren wants for his pumping engine; he does not want something that will jump up and down at every stroke of the pumps, but he wants something very solid. That is what we are trying to give him. The pneumatic method in general is simply a way of doing what under different conditions could be done without the pneumatic method. We simply employ it to keep out the water. It has been a growth, a gradual development from the old diving-bell. It is not necessary for me to tell you what a diving-bell is, as you are familiar with its principle, and know that it is shaped something like a goblet turned upside down, and allowed to settle in the water; as it settles, its weight keeping it steady and the sides at the same level, the air caught and imprisoned in the diving-bell is compressed; the more the contained air is compressed, and the less becomes the air content and the greater the content of water. That was used in the last century by some ingenious man, first as an experiment, then afterward in recovering treasure from sunken wrecks. It had a limited use in that way. It was not until the development of the machinery end of the business that somebody put compressed air into it, and it became of value to the engineer. The diving-bell in its simplest form had a certain amount of water in it; that water prevented work being done right at the bottom of the well. (The speaker drew a rough sketch on the blackboard to illustrate the principle stated.) Where the diving-bell rested it was necessary for men to work in a certain depth of water which rose in the bell. Now, by the introduction of compressed air, the pressure in the air space could be made to equal the water pressure below; the result would be that the water would be prevented from thus rising in the bell as it did before the use of the compressed air; and the workmen thus could stand on the bottom, where the bell rested, dry-shod.

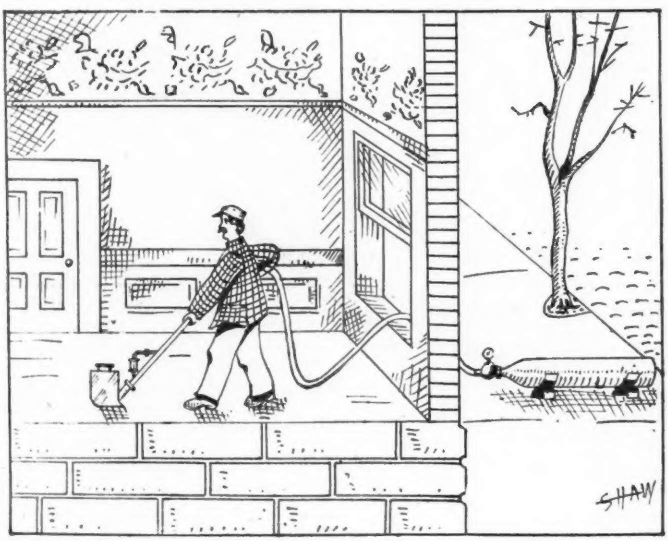


FIG. 2. CLEANING CARPETS OF PRIVATE HOUSE.

The development from that to the modern caisson was a gradual growth, as I have said.

One of the earliest instances in which the pneumatic method was used in the building of a pier was the Salt Ash Bridge, built by Brunel. I have not my books of reference here, or I might have looked this up; but it is unimportant. It was a crude method, extremely clumsy and difficult. There was a wooden foundation for the pier cut up into innumerable small pockets, with tortuous narrow passages for egress. The work was done under great difficulties; the workmen had to go up in these narrow chambers in the caisson, fill bags with mud, and then carry them to the air-lock; and in that way the excavation was made. It was very slow and very difficult. The development from that day to this has been a development in the direction of the perfecting of the caisson as an excavating machine. The caisson has now become like a box turned upside down; and the larger the opening inside, and the easier the means of getting material out, the easier the caisson for working in it. As the structure requires considerable strength in all its parts, the calculation of a caisson is a matter of great difficulty, because the strain that comes upon it is not a definite one, as in bridge structures, where you can separate the strains and deal with them as you please. In a caisson there is no telling what strains will come upon it. The real pressure is a problem that defies accurate calculation. There is no assumption upon which it can be exactly calculated. It must be gotten at as the result of experience guided by engineering knowledge.

From the primitive diving-bell, which had no method of ingress or egress, except under the edge, the modern caisson has developed and become a structure in its simple form like a rectangular pier, thus: (making sketch on black-board). Openings are carried up through the pier, or whatever the structure is, through the caisson and through the masonry on top. There are several ways of making the excavation. It is necessary to get dirt out from below the pier in order to sink the caisson. The first, and perhaps the simplest method, which you will probably see at California this afternoon, is by blowing it out. The air pressure in the caisson being in general slightly higher than the water pressure, this air pressure has been found sufficient to carry a certain amount of material with it through the pipe. It is usual to put in a 4-inch ordinary iron pipe, having at the top an elbow generally of a large radius. This pipe is carried through the caisson in an air-tight manner. The lower end has a plug valve giving a full 4-inch circular opening; and below the valve an extension of the pipe and usually another elbow. Sand or other fine material, as the air escapes, is fed by hand or shovels in front of the pipe; and the current of air going through the pipe carries with it a very large proportion of this soft material. That method is very simple, very rapid, very safe; but it does not work with rock. It works with difficulty with certain kinds of clay. Certain kinds of clay we cut up with a jet of water and carry it through the pipe. That led to the introduction of an excavating air-lock.

I want to say a word about air-locks. An air-lock is an arrangement for getting from the inner pressure to the outside pressure. In its simplest form it consists of a cylinder, or boiler, with two heads. On the upper head there is a door, and the lower head also has a door. One of these doors is always kept closed to retain the pressure. Both doors open downwards. At its lower end there is a shaft or pipe connecting it with the caisson; men or material can come up this shaft and go through this lower door, and while it is opened the upper door is closed. At this time the pressure in the air-lock will be the same as the pressure in the caisson. The lower door is then closed, shutting off the supply of air from the caisson into the lock; the valve at the upper door is then opened, allowing the compressed air contained in the lock to escape; and when the air in the lock is the same as the outside pressure, the upper door will drop, and communication is opened with the outside air. In the same way, returning, the lower door being closed, the men may go through the upper door, which will then be closed and the lower valve opened, allowing the air in the caisson to flow in the air-lock till the pressure there is equal to the pressure in the caisson, when the lower door is dropped, and then communication is open to the caisson. This lock can be used in excavation by having the workmen carry up through it bags of broken rock, or other material. That was improved upon later on by the so-called "O'Connor bucket." The bucket carried a valve on the top of the bale, which

closed the hoist-pipe. In this arrangement the hoist-pipe, or shaft, passed through the roof of the caisson, and terminated at its lower end in a cylindrical extension projecting into the working chamber below the roof of the caisson. Just below the roof of the caisson the shaft contracted slightly, and was fitted with a conical valve seat corresponding to a valve-plate of circular form fastened to the bale of the excavating bucket. When the excavating bucket was lowered through the shaft into position in this cylindrical extension in the wooden chamber, the valve on the bale fitted into the conical valve seat, and was held there by means of set screws, operated from the interior of the working chamber. Doors in the side of this cylindrical extension were then opened, allowing dirt and small pieces of rock to be shoveled into the bucket. When the bucket was filled, these doors were closed, the pressure equalized, and the conical valve released, when the bucket and its contents could be hoisted to the surface, dumped, and returned for another load.

An improvement on this method was a pneumatic hoist devised by the eminent bridge engineer, Mr. Geo. S. Morrison. I have never seen this method in operation, but understand that it is satisfactory and efficient. It goes among the "sand-hogs" by the euphonious name of "Morrison's go-devil."

I am using at California a lock which enables an ordinary bucket, or even a barrel of cement, to be passed in and out of the caisson without detaching it from the hoisting rope leading to the derrick. The lock has a simple lower door hinged on a shaft, which shaft extends to the outside of the lock through a stuffing-box. On the outside is a counter-weight lever and counter-weight, to balance the door and afford means of operating from the outside. Above the lower door is a cylindrical section, called the bucket chamber, large enough to contain the bucket. The opening above the bucket chamber, instead of being closed by a single door, is closed by two doors working to and from the centre. When these doors are closed they completely close the opening, and form a tight joint with each other, with the exception of a small opening at the centre. In this small opening at the centre fits a stuffing-box of simple design, through which the hoist-rope passes. The two doors then close around the rope contained in the stuffing-box and completely prevent the escape of air through the opening, while permitting the rope to pass freely. As soon as the bucket is filled in the working chamber an electric bell rings above, and the engineer at the derrick hoists the bucket into the bucket chamber. The lower door is then closed, a valve is opened permitting the air in the lock to escape, the upper doors are then opened, and the bucket is hoisted out, the stuffing-box remaining on the rope just above the bucket. In returning, the operations are reversed.

The caisson is an excavating machine, as well as a foundation, and must be considered in that light. Its development has been largely due to the specialists who have been employed in this line of work. Just as in the bridge shops in America the design has been developed, so in caisson work men like Eades, Sooysmith, Morrison, Hermany, and others have added from time to time new points, all tending to make the caisson more and more efficient in its dual capacity of an excavating machine and foundation.

Before I leave the subject of the development of the caisson, I must say a word for "the man behind the gun"—the "sand-hog." He is a tramp; he has no home, no family, no morals, no religion; he is nothing but a "sand-hog." He got the name from the fact that at one of those jobs at Havre de Gras, close to the Chesapeake Bay, the farmers' hogs used to go down at low tide and root in the sand; they covered themselves with mud; and the workers in the caisson, seeing the close resemblance between themselves and the farmers' hogs rooting in the mud, christened themselves "sand-hogs"; and ever since then they have gone by that name. They are a class by themselves, and follow a pressure job from one part of the country to the other. About the time we are ready to put on the air, some seedy individual pokes in his head at the window and says: "Say, Mr. Moran, when are you going to put on the air?" Yet the sand-hog has done much to develop pneumatic work. It was a "sand-hog" who first suggested the idea, or observed the fact, that by allowing a slight flow of air above the blow-pipe soft material could be better and more easily blown out; and so, without remembering the name of the "sand-hog" who suggested the plan, we arrange to have a little vent in our blow-pipe.

The "sand-hog" is an interesting study to me; he has his peculiar disease, the "caisson disease," called by the "sand-hog" the "bends." The action of high-pressure compressed air on an ordinary man is temporary; you feel it while you are in it; an hour after you are out you don't feel it, and you are all right. But it may make great havoc with the human system. It affects the ears. If the Eustachian tube is clogged, the pressure on the outside will rupture the ear drum. I know engineers and "sand-hogs" who are deaf from that cause. It also will produce paralysis, temporary or permanent; and it may produce death. The subject has been studied both from a medical and practical standpoint. I am glad to say that in recent years the mortality and injury from the use of compressed air is greatly reduced. Still, there is always present danger in compressed-air work. The "sand-hog" knows nothing about the "caisson disease," technically so-called. He only knows it as "the bends" from practical experience. It was many years before I found out how this disease got the name of "the bends." It seems that when Eades was putting down the foundation of the St. Louis bridge, there was a peculiar form of style of carriage among fashionable ladies of this land, which was known, and is, no doubt, remembered by many of you, as it is by myself, as "the Grecian bend." And when a workman came out of the caisson and felt pains in his knees, and a "crick" in his back, and when he could not walk easily or well, his friends would laugh at him and say: "You are trying to walk the Grecian bend." In time the "Grecian" was dropped, and the disease was named by the workmen "the bends." I don't think our workman here on this job will be so troubled, because the air pressure is very light. We can do much to relieve them now-a-days if they do get "the bends."

Now, gentlemen, this is a windy subject. We have to keep our compressors running day and night; and sometimes I think when I get started on this subject I also will run on all day and night; but I will not do it! I am at the end of my fifteen minutes and will close, thanking you for your kind attention.

A hearty vote of thanks was tendered to Mr. Moran at the end of his remarks.

Liquid Air

Compressed Air and Liquid Air as Used in the Simplon Tunnel Construction.

Mr. Axel Larsen, M. Inst. M. E., in Cassiers for January, 1900, has an interesting article illustrating and describing the progress of work on the Simplon tunnel.

Among the ordinary uses of compressed air on this work we also find some extraordinary uses. To clear away the debris Mr. Brandt, of the firm of contractors who are building the tunnel, proposes to use a gigantic air gun 300 feet long, and with a calibre of 6½ inches. This gun is charged with compressed air at a pressure of 100 atmospheres and fires a projectile of 900 gallons of water. When the cannon has been placed in position the powder fuses will be abandoned and the shot firing will be done by electricity. In this manner it will be possible to fire the explosive in the bore holes and gun simultaneously. Thus at the same moment as the solid rock is splintered into a heap of fragments by the blasting charges a huge volume of water is hurled against the debris which is instantaneously washed away from the working face and left against the wall some 50 yards further down the tunnel.

It is at this tunnel that the use of liquid air as an explosive was first tried, and much is expected of it. The cost of it is comparatively low, as liquid air could be made on the spot where ample water power is available. The minor difficulties with it have been overcome and it is now possible to keep liquid air in specially constructed vessels for fourteen days and longer. Cartridges of 6 inches diameter would have a life of over a quarter of an hour, which would be sufficient for loading and firing. But one great drawback remains. It is the danger of premature explosion of the cartridges when accidentally brought into contact with fire, and as naked lights of the oldest type are used everywhere in the Simplon tunnel, such an accident would seem extremely probable.

A liquid air cartridge is made as follows: A cylindrical paper or cardboard wrapper is filled with the powdered material intended to support combustion, the liquid air being, of course, the oxidizing agent. The cartridge is then bodily immersed in liquid air. In from 15 to 20 minutes it is soaked through and is ready for use. Several mixtures of carbonaceous bodies have been tried as substances supporting the combustion, and it has been found that not all of them involve the same degree of danger. Some of the cartridges made as above described burn away more or less violently when ignited by flame, while others explode almost immediately. Unfortunately, the mixtures which have proved comparatively safe are also the least effective. It, therefore, remains to be seen whether a mixture will be found which combines sufficient explosive strength with safety of handling. Meanwhile, it may be said with a fair degree of certainty that liquid air mixtures will never be generally introduced as a blasting agent, for apart from the difficulty of preparing the cartridges under ordinary mining conditions, it is an exceptional thing to meet with 6¼-inch cartridges in ordinary mining (1 to 2 inches being the usual sizes), and a thinner cartridge does not retain the liquid air long enough to be relied upon for shot-firing purposes.

With the work in the Simplon tunnel it is, of course, a different matter. The conditions there are different. It is altogether an exceptional case, and if the experiments with liquid air should ultimately prove successful, the advantages achieved may mean the completion of the tunnel in 1903 or even earlier.

Professor Linde, of Munich, who has done so much to render the liquefaction of the atmospheric air an industrial success, personally conducts these experiments at his labdratory near Brig, and his thorough knowledge of the subject promises a successful issue, if it is to be attained at all.

Liquid Air in Medicine and Surgery.

Dr. A. Campbell White, writing for the Medical Record, says:

"I think there is reason to hope that we have in liquid air a therapeutic agent which will remove many otherwise obstinate superficial lesions of the body and cure some lesions which have heretofore resisted all measures of treatment at our disposal, including the knife. I am firmly convinced, with the experience already had with its use, that it is a specific in the treatment of such diseases as herpes zoster (painful neuralgia, accompanied by an eruption), sciatica and intercostal and facial neuralgia, affording instant and continued relief after one application over the spinal end of the affected nerve. The use of liquid air in medicine, i. e., in pulmonary diseases, in the reduction of fever, etc., opens a large field, one which presents many obstacles at the very start, but much hope for the future."

Dr. White, who is known as the first New York physician to use anti-toxin, became interested. Mr. Tripler gave him the use of his laboratory, and Health Commissioner Jenkins gave him the privileges of the department's hospital laboratory to test the effects of liquid air on germ life.

Dr. White began treatment of the human skin by curing ulcers of the leg. The doctor put himself on record as saying: "So many of these cases have been successfully treated with liquid air that it can be positively said that we have nothing at our disposal to-day which will cure ulcers so quickly, thoroughly and with as little pain."

Dr. White accounts for the phenomenal quality of liquid air in this way: He says in liquid air we have pure cold without moisture. The danger in getting one's feet frozen is not long exposure to cold, but to cold and moisture combined; moisture preventing evaporation.

Liquid Air for Blasting.

With the excitement that attended the first application of liquid air, it was claimed that a new agency had been placed at the disposition of mankind that would be used for countless important purposes. Some time ago Stone published the claims that were set forth as to the merits of liquid air for blasting purposes, especially in gaseous mines, where sparks are dangerous.

Some experiments, conducted by the Vienna Crystal Ice Company, in the presence of representatives of the Austrian Technical Military Committee, may, therefore, be of interest. These experi-

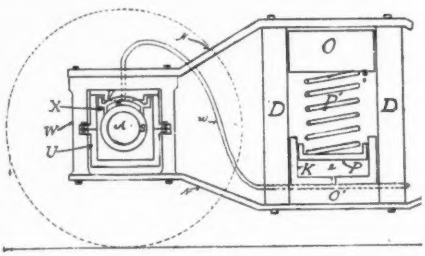
ments are by no means decisive, since they were certainly not made under favorable circumstances; but they are instructive. The liquid air was obtained from the Linde Company, in Munich, and was transported in open flasks, provided with a Dewar vacuum jacket. These flasks were packed with felt and cotton; over the open neck, which projected through the lid of the wooden case, a cap of felt was loosely fitted. When dispatched, the liquid contained a mixture of oxygen and nitrogen in the ratio of 75 : 25. During the 72 hours which elapsed before actual use, the greater part of this time being spent on transport, half of the liquid had evaporated, and the remaining liquor contained 85 per cent. of oxygen; nitrogen is more volatile than oxygen. Two kinds of cartridges were made of kieselguhr, mineral oil (solar oil), and the liquid. In the first case the kieselguhr and oil were mixed in a wooden basin, the liquid added gradually, and the paste ladled in paper cartridges, clothed with asbestos. In the second case, the earth and oil were charged into the cartridge, which rested in a double sheet-metal cylinder with a separating layer of felt, and the liquid air gradually poured into the cartridge until the mass was thoroughly impregnated. In both cases the formation of mist and hoar frost sufficiently indicated how much of the oxygen escaped during the preparation. The cartridges could be handled, but the men did not care to squeeze them in firing the primers and detonators; as a consequence, one cartridge missed fire. Holes 30 inches deep were bored in rock. It resulted that these so-called oxylignit cartridges were hardly strong enough, as too much oxygen had evaporated. The cartridges of the second type did not prove so powerful as the others, probably because the lead cases furthered evaporation, especially from the bottom of the cartridge. On these results, Artillery General-Engineer Hess has commented to the following effect: The preparation of the cartridge is wasteful and dangerous to the eyes, etc.; and, owing to the rapid evaporation, it is further impossible to guarantee the strength of the cartridge, even in the roughest way. Kieselguhr and oil seem to be suitable absorbents and oxylignit an effective blasting agent, though comparative tests have not been made yet. The cartridges must be used within, say, 15 minutes of their preparation. There is no danger, hence, from missing fire. But, on the other hand, it will be difficult to fire many cartridges simultaneously, and, strictly speaking, the cartridges should be made on the spot, and be in a very hard condition. That would scarcely be possible below ground; the spurting liquid might break the glasses of the hot safety lamps, and it remains to be investigated whether the large volumes of oxygen might not lead to spontaneous ignition of marsh gas or coal dust. The evaporating oxygen would, on the other hand, improve the air, and the blasting would not contaminate it. Some of these objections are very serious, especially the unreliability of the power of the cartridge, and the short period during which it remains active. The cartridge cannot, of course, be sealed, nor can the vessels in which the liquid air is transported. For military operations oxylignit would certainly not appear to be suitable. But the whole question is only in its experimental stage, and better methods of making cartridges could probably be devised.—Stone.

Air Jets

A novel application of compressed air has recently been patented on a "Compressed Aid Mechanism for Vehicles and Other Devices." With this simple device the inventor, F. Schumacher, of 148 Sackett street, Brooklyn, N. Y., proposes to reduce the friction on the axles of heavy rolling stock, by confining a volume of compressed air in a system of pistons and chambers in such a manner so as to enable the axles of a vehicle to rotate against the air pressure without friction.

The illustration shows the principle of the invention as it is applied to a freight railway truck. Every detail of the operation of the device is automatic, simple and positive. The arrangement consists of a pressure accumulator, air chambers for the axles, and a pressure regulating mechanism. A pump and a small storage tank constitute the automatic pressure accumulator, and maintains the necessary pressure. It may well be compared to the inflation of a pneumatic tire; once filled, it lasts for a long time. From the

storage tank the pressure is regulated by a governor, admitting and expelling the air to and from the chamber "a" and the space "e" below piston "P" in pot "K," chamber "a" and space "e" being connected by a pipe "w." The adjustment of the governor is such that the pressure in these spaces is maintained proportional to the load to be maintained by the air. The pot "K," with piston "P," serves to regulate the pressure under load vibrations, reducing or increasing the volume



in "a," "w" and "e," without admitting or expelling any air to or from said air spaces. The load resting on bolster "O," spring "P" and piston "P," enables the air in "e" to exert an anti-vibrational influence upon the same, absorbing all trembling vibrations of the vehicle not absorbed by the spring.

The fittings on the axle consist of a collar "S," easily removable; a bearing-block "X," with its piston-shaped lid "V," a box or casing "U" for the axle, and a frame "W" for casing "U."

The bearing-block "X" has a cylindrical top for "V" and a recessed surface for an air space "a." It being fitted air tight to "V" and "S" no air can escape, and "S" can rotate with axle "A" against the pressure in "a."

Any number of air-chambers on the axles may be connected to one pot, "K," it being only necessary to properly proportion the combined lifting areas between the chambers of the axles and the lifting area of the air in pot "K."

The pressure in the storage tank is at all times greater than the pressure in the chambers of the axles and connections, it being in the latter spaces at a maximum of 175 lbs. on railing cars, and considerably less for lighter vehicles. The advantage claimed in the application of this device to heavy rolling stock is the following:

Frictional reduction of over 90 per cent.

A longer life of the bearing.

The saving of over 75 per cent. of oil.

A positive prevention of hot bearings.

Increased safety for the rolling stock.

Increased speed of fast trains.

Better comforts for the traveling public.

Smaller coal bills.

Smaller motors.

Decreased expenses in street railway equipment.

In its issue of Dec. 15, the Street Railway Review asserts that air cars have been taken off the Twenty-eighth and Twenty-ninth street lines in the city of New York. As the statement has been made also in other technical papers, it may be as well to state here, in justice to the American Air Power Company and the Metropolitan Street Railway Company, that this is wholly untrue. The air cars have been in practically continuous operation for many months, the only interruption in their service being one or two months ago, or so, due to a temporary breakdown of the main air compressor at the station. The cars are now, and have been since that single interruption, running regularly, and apparently to the satisfaction of the public.—Street Railway Journal.

The new edition of the mammoth catalogue of Manning, Maxwell & Moore, New York, is about to be issued. It will be devoted exclusively to the illustration of iron-working machine tools. Those who have new tools that they would like to have illustrated in this catalogue should immediately correspond with Manning, Maxwell & Moore at their New York office. This should be particularly interesting to the manufacturers of pneumatic appliances.

The new main power station of the Third Avenue Railroad Company, New York, is to be the largest station in the world. The station will contain 16 main generating units.

For the purpose of cleaning the electrical machinery two Westinghouse air compressors are to be provided to furnish compressed air under a pressure of 70 pounds per square inch. Each pump is to have the capacity of compressing 20 cubic feet of free air per minute.

Air is to be stored in two Westinghouse standard locomotive reservoirs, from which mains and branch connections are to be led to the various machines. A suitable number of hose and nozzle equipments are to be provided for directing the air when used for cleaning. Connection is to be made from this system to the oil system for handling cylinder oils.

The New York Air Compressor Company reports sales of over ten air compressors in as many days. These include a large duplex compressor for Japan and four compressors of 1,200 cubic feet capacity for the Pennsylvania Railroad.

Pneumatic Tools

American tools are making their way into Europe and the latest extension is that of the Standard Pneumatic Tool Company, who has through Mr. Henry J. Kimman, established works at Chippenham, near London, for the manufacture of the "Little Giant" pneumatic tool for the European trade, and installed a plant of the most improved machinery and labor-saving appliances. Mr. Kimman has just returned from his European tour, and before his departure for this country the plant was in full operation and turning out tools in large numbers. He states that the opposition to the use of pneumatic tools by labor organizations on the other side of the Atlantic on account of their labor-saving qualities is gradually dying out, and everywhere progressive concerns are installing machines of this description. During the past year the "Little Giant" pneumatic drills, hammers and boring machines have met with much favor in the export market and they are being adopted by some of the largest foundries, shipyards, machine shops, railroad and boiler works and manufactories in Great Britain, Germany, Italy, France, Sweden and Russia, one concern in Holland having placed an order for $25,000 worth of pneumatic tools, and other orders aggregating this amount from the other countries herein enumerated. The domestic business is also increasing, particularly with the railroads. The demand for the "Little Giant" tools will, if continued, compel the enlargement of the company's works.

The Chicago Pneumatic Tool Co. report a large increase of their sales with the opening of 1900, their tools going to all parts of the world and into every variety of uses. They are now receiving returns from a general letter to all customers, and the flattering responses show that their tools and appliances have met with the highest and continued favor everywhere. As new demands arise, new tools are produced to meet such demand, and the high quality of material and workmanship used in all their productions gives them a standard of excellence which is recognized the world over. Among their latter tools, the Boyer Long Stroke Riveting Hammers are found to meet the requirements of all classes of riveting, particularly on boiler work, where the heat results are attained with a great saving in labor and expense. This company will soon issue a new series of catalogues, showing their full line of pneumatic tools and appliances.

PATENTS GRANTED DEC., 1899.

Specially prepared for COMPRESSED AIR.

638,392. — AIR-SUPPLYING DEVICE FOR DIVING PURPOSES. Frank A. Hensley, San Antonio, Texas.

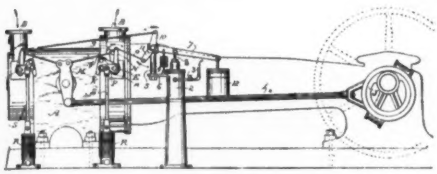
An air-supplying device for the purpose described, a submergible air reservoir having an open water-chamber extension at the bottom, air supply and exhaust pipes communicating respectively with the interior of the reservoir and the water-chamber extension thereof, a mouthpiece having separate branches, a single nipple connection, and check-valves arranged respectively at opposite sides of said nipple connection, and inhaling and exhaling tubes respectively connecting the separate branches of the mouthpiece with said air supply and exhaust pipes

638,409. — RECEIVING - TERMINAL FOR PNEUMATIC - DESPATCH SYSTEMS. Charles F. Bodinus, Austin, Ill.

A pneumatic-despatch terminal, tube having a carrier-discharge branch, the direction of discharge being transverse to the air-return portion of the tube, a valve for the discharge branch openable by impact of a carrier, the discharge branch being the only means of communication with the interior of the tube opened by the discharge of the carrier, and being prolonged beyond the air-return portion of the pipe to form an air-cushion, but the distance from the outer end of the discharge branch to the more remote side of the air-return portion of the tube being not greater than the length of the carrier intended to be used in the system.

638,460. — AIR - COMPRESSOR. John H. Hopps, San Francisco, Cal. Assignor to the Fulton Engineering & Ship-Building Works, same place.

An air-compresser having two or more inlet-valves, each of which is operated through the medium of a spindle and mechanism connected with the motive power; gripping devices connected with the motive power and operated synchronously with the



movement of the inlet-valves, said gripping devices being adapted to automatically engage or release the valve-spindles, means for operating the gripping device from the motor or engine to move the inlet-valve and a tripping mechanism adapted to act on each gripping device consecutively as the pressure in the receiver increases above a fixed point.

638,928. — PNEUMATIC RAM. Arthur L. Humphrey, Colorado City, Colo.

An apparatus of the character mentioned, the combination of a track-bar having means for supporting the same in place, a roller-carriage adapted to the track-bar to travel freely thereon, a ram mechanism mounted on the carriage to travel and recoil therewith, said carriage having means whereby it may be adjusted manually on the track-bar, and a stop on the track-bar to limit the recoil of the ram and the carriage.

639,317.—PNEUMATIC PYROMETER. Edward A. Uehling, Newark, and Alfred Steinbart, Carlstadt, N. J.

A pneumatic pyrometer, the combination with a pipe system having aperatures of a steam operated device for conveying air through said pipe system, a pot through which part of said pipe system passes and into which said steam-operated device discharges its exhaust and an indicator connected with said pipe system, substantially as herein shown and described.

639,593.—MERCURIAL AIR-PUMP. Hiram S. Maxim, London, England.

In a mercurial air-pump having a head for the mercury communicating with the vessels to be exhausted and with fall-tubes through which the mercury from said head descends to remove the air from the said vessels; the combination with the said head, of a hollow stopper to contain hygroscopic material, of an inlet-nozzle on said stopper, of a float for regulating the flow of mercury through said inlet-nozzle, of means for comminuting the mercury entering said head and of means for keeping the space in said head above the mercury in a vacuous condition.

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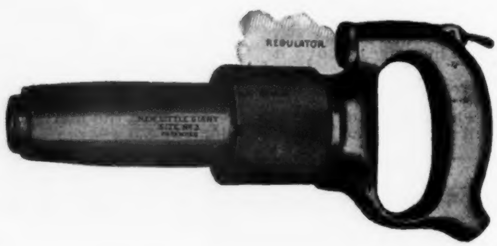

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With few exceptions this question has been dealt with in this country as a fad, and while the fact has been recognized and confessed by all, that there is a broad field for automobiles, no systematic effort appears to have been made to develop their uses. There has been lots of talk of applying them to business wagons, but little has been done in that direction. Many schemes have been devised by what might be termed amateur mechanics, who have claimed much, but who have really accomplished but little.

The men forming this Company have no pet theories or pet devices, but desire to go into the market with the best power and machine obtainable, applying it to practical work. They recognize the fact that there are a number of automobile engines in the market now, and that some of them may be developed to do the work planned.

The full development of this industry will not be accomplished by talking. The machines must be put into practical use. This will develop defects for which remedies can be applied.

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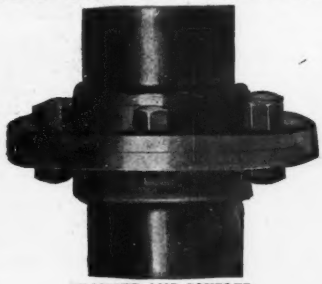

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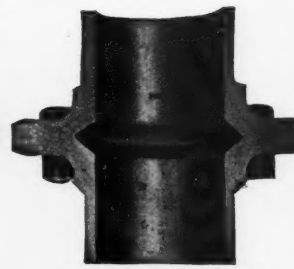

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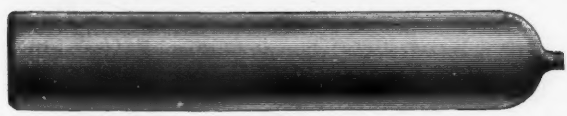

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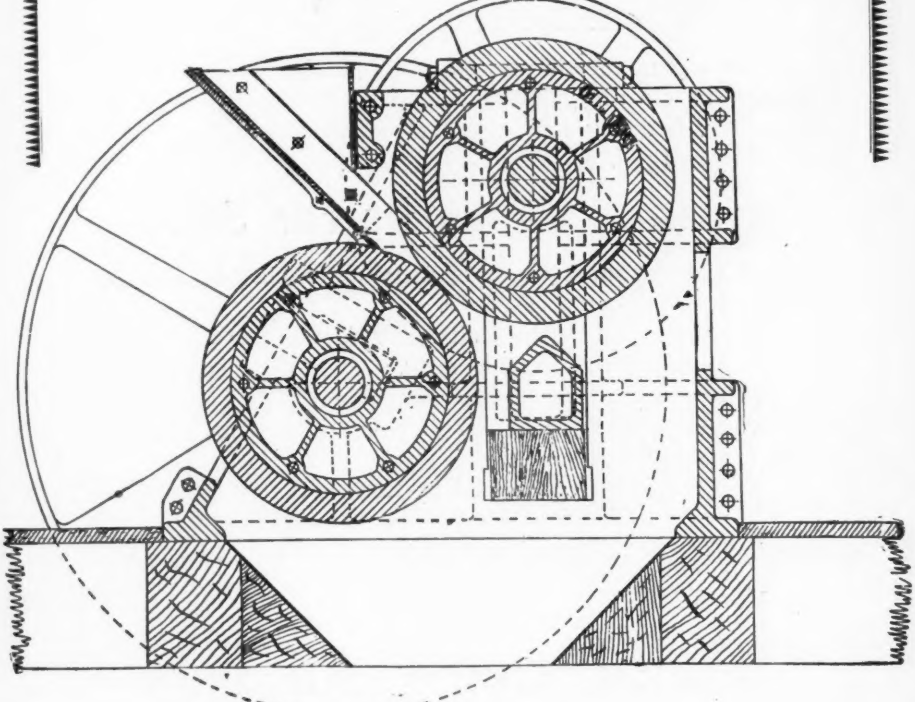

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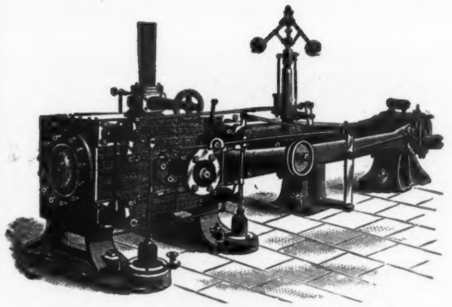

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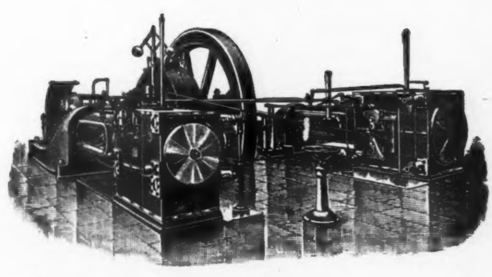

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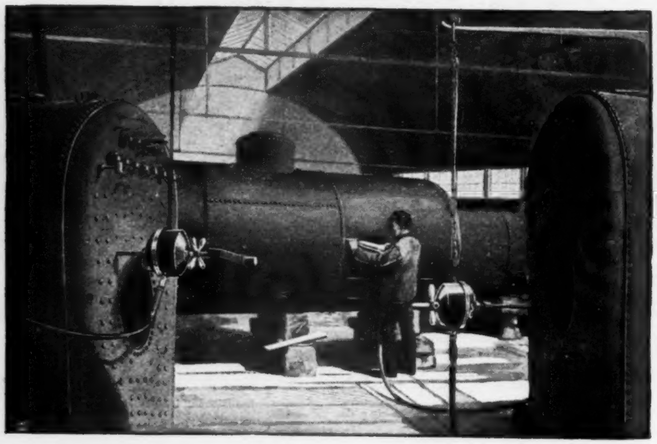

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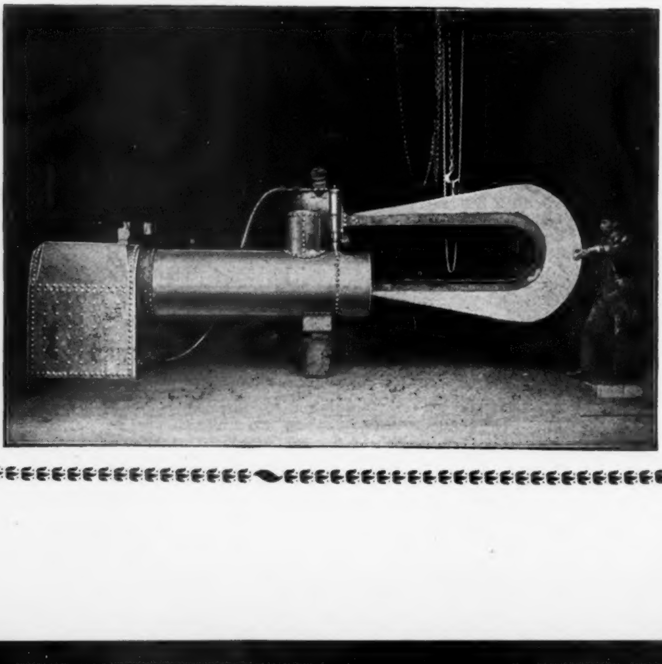

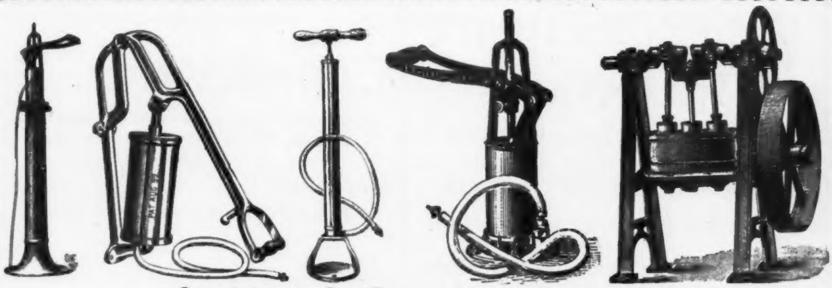

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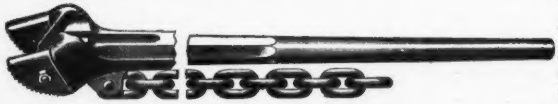

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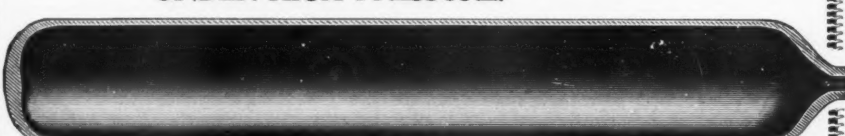

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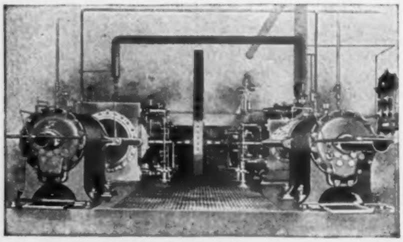

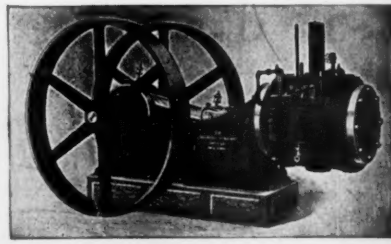

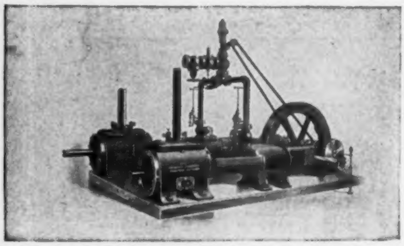

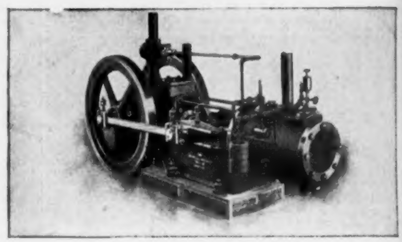

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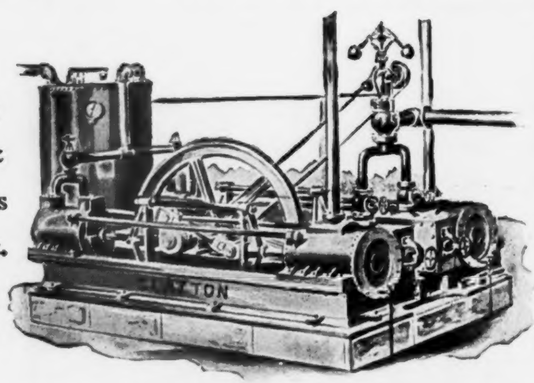

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